Macro EXEL Fish Counter

User Manual

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Contents

PREFACE – The Micro/Macro Fish Counters 2
Counting Head 4
Set Up 5
Pumping 5
Vacuum pumps 5
Netting 5
Start Up 6
Main Screen 7
Set Fish Size 9
Test with water only 9
Start Counting Session 10
Store and Continue Counting 10
Troughput Video and Fish spread 11
Throughput: 11
Video: 11
Fish spread: 11
Progress bar 12
Clear one channel 13
End counting session 13
Settings 14
Settings 14
Information 17
Calibration & Visibility 18
Visibility 18
Counter calibration 21
View report 21
View record 22
Storing 23
Technical specification 23

PREFACE – The Macro EXEL Fish Counters

VAKI Aquaculture Systems thank you for choosing the MICRO and MACRO Range of fry and smolt counters.

These counters are used in many aquaculture enterprises where an accurate knowledge of fish numbers is important. Applications include counting fish when grading, accurate stock control and when transferring fish between tanks and delivering fish by helicopter, well boat and truck.

The MICRO and MACRO counters have been developed in collaboration with a number of leading fish farming companies and used worldwide for counting a wide variety of species including Atlantic and Pacific salmon, trout, char, sea bass, sea bream, cod, tilapia, cobia, yellowtail, flatfish and most other farmed fin fish species.

VAKI continue to develop the features and functions of the counters for use with more specialised species including prawn, shrimp, eel and ornamental fish.

The counters are based on a digital scanning camera and computer vision. The outlines of objects that pass beneath the camera are recorded and custom designed software is used to analyse the images and count the individual fish.

The fish enter the counter and the water from the fish pump or spray bar then carry the fish over the curved counting channel. The fish then pass over a light source and a mirror above the light reflects the images of each fish back to the digital camera where the outlines are recorded and counted.

The MICRO is ideal when counting small fish from 0.2 g and has a 500mm wide counting channel, the MACRO channel is 1000mm wide and ideal for counting both fry and larger fish such as smolts. Both counters can be supplied with multi counting channels, which can be used to count separate batches of fish simultaneously, for example when grading.

This manual is a guide for the MACRO EXEL Counters.

Warranty

VAKI Aquaculture Systems Ltd. offers warranty for and manufacturing defects that appear within one (1) year from the date of delivery from VAKI Iceland, on condition that the equipment has been assembled, used and maintained in accordance with the instructions for assembly and use. Changes to the start date of this warranty, such as delayed delivery to the user, must be reported to VAKI upon receipt of the equipment and agreed in writing.

VAKI undertakes to repair all defects that are due to faults in the design, materials used, or manufacture of the equipment. These defects will be rectified by repairing the equipment, or replacing components. The customer may be required to return the complete unit or parts thereof to the factory in Iceland for repair. VAKI accepts corresponding warranty for original parts fitted by VAKI as replacements, for a period of one (1) year from the date supplied.

VAKI will ***not*** be liable for:

- *Incorrect assembly and use, or inadequate maintenance.*
- *Defects which result from the fitting of materials, components, or devices not supplied by VAKI, and which are purchased and fitted by the user.*
- *Defects due to changes made to the equipment by the user, without the written consent of VAKI.*
- *Faulty or inadequate repairs carried out by the user.*
- *Normal wear and tear of the equipment.*
- *Faulty connection of electrical equipment.*
- *Faults caused by excessive voltage.*
- *Damage or stoppage due to immersion of the computer or camera in water.*
- *Damage to electrical supply cables.*
- *Any economic loss that may arise from production stoppage.*

If faults or defects appear in the equipment, the user must report this in writing to VAKI or its appointed representative as soon as possible, and without unjustifiable delay. The report must be sent within two (2) weeks from the expiry of the deadline, which is one (1) year from the date of supply by VAKI Iceland.

<u>If the purchaser does not inform VAKI or its representative within the time limits stated above, the purchaser shall forfeit the rights of the warranty.</u>

Counting Head

The counting head contains the camera

On the back are connections and ports required to connect the counter to 1.Ethernet, 2. 12V for computer, 3. 110/220V power inn , 4. 12V lamp.

Computer with touch screen

1. USB port, for keyboard, mouse, printer.
2. USB port, for keyboard, mouse, printer.
3. Ethernet port.
4. Connection for main earthed power.

Set Up

When setting up the MACRO it is important to note the following:

- The counter should be placed on a flat and stable surface.
- Set the counter level by adjusting the height of the legs to ensure both fish and water are evenly spread across the scanning area.
- Locate the counter so that the touch screen is easily accessible and not exposed to water or direct sunlight. Note that in hot weather, high temperatures can affect the computer.
- When counting in extreme cold weathers keep the counter running to prevent the light from flickering.
- Before each count check that the mirror is completely clean and free from any stains, residue or water droplets.
- Ensure that all pipes and hoses are securely fastened.
- Connect the lamp cable to lamp connection on counting head.
- Connect external alarm or batch splitter to the “Alarm” port
- Connect the power cable to earthed power outlet. The use of a UPS (un-interrupted power supply) device is recommended. The counter power requirement is 80-100W**.**
- Ensure that water and fish have a continuous free flow from the counter. Backpressure in the pipes can overload the counter.
- Take care not to move or shake the counter while it is operating to protect against hard disk failure.

Pumping

When using a fish pump to transfer fish to the counter it is important to ensure an even flow of fish and water. Uneven delivery of fish to the counter can cause inaccurate counting as the number of fish may exceed the capacity limits.

It is also important to test the counter on the correct fish size settings pumping water only to ensure excess water does not create over-counting and adjust pump as required.

Ref: section **7.2 “Test with water only”**

Vacuum pumps

When using larger vacuum pumps it may be necessary to provide additional dewatering or a buffer tank. Short bursts of many fish can overload the counter and both excess water and white water can affect the performance of the counter particularly when counting smaller fish.

Netting

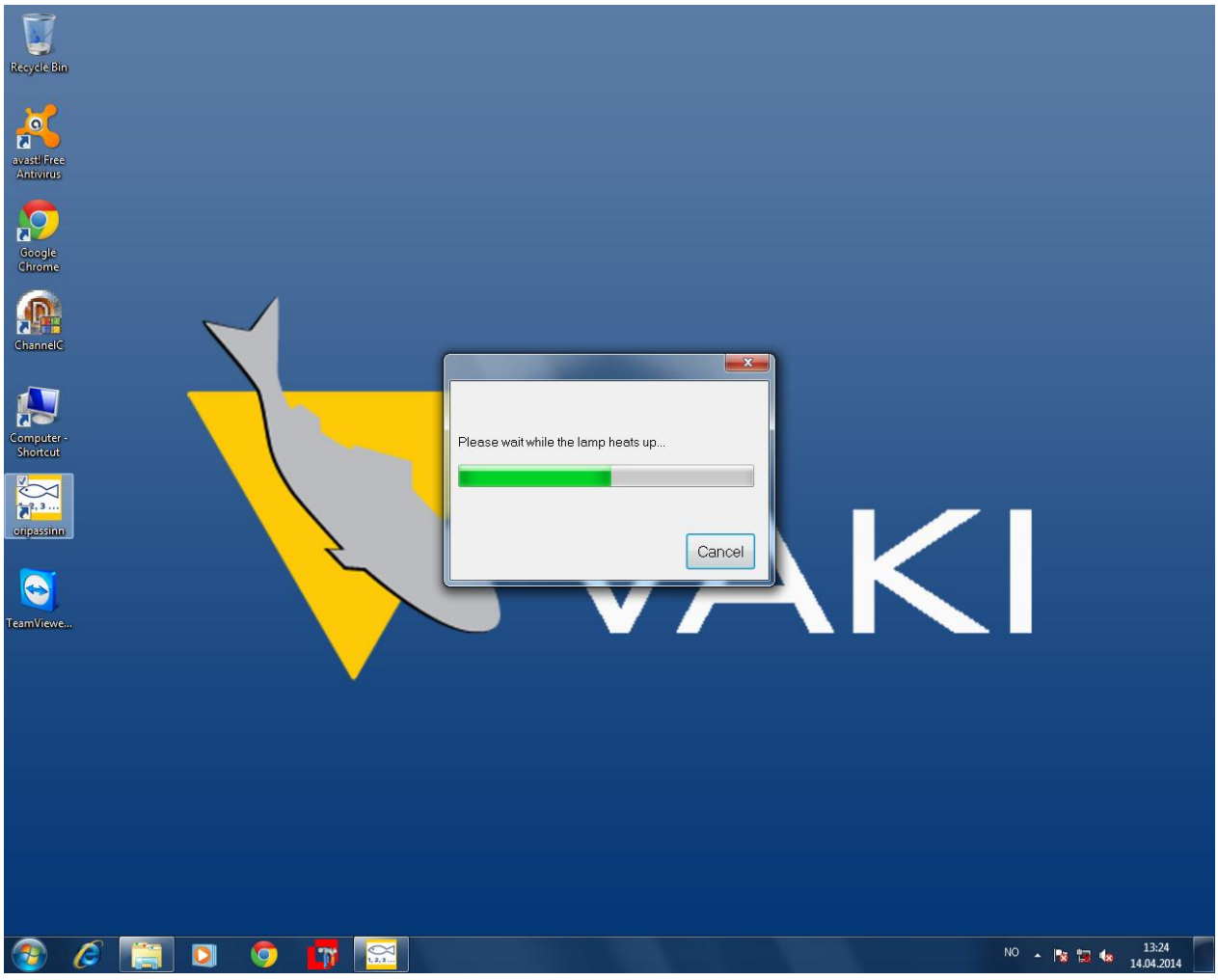
When netting the fish into the counter it is similarly necessary to supply a sufficient amount of water for gentle handling of the fish and maintain an even flow of fish over the curved counting channel.

Start Up

The counter is now assembled and set up as instructed.

***Turn on counter*.**
The following window will be shown on screen. The colder the environment the longer it will take for the lamp to reach working temperature.

The green bar shown is not an indicator of lamp temperature only a preset timer.

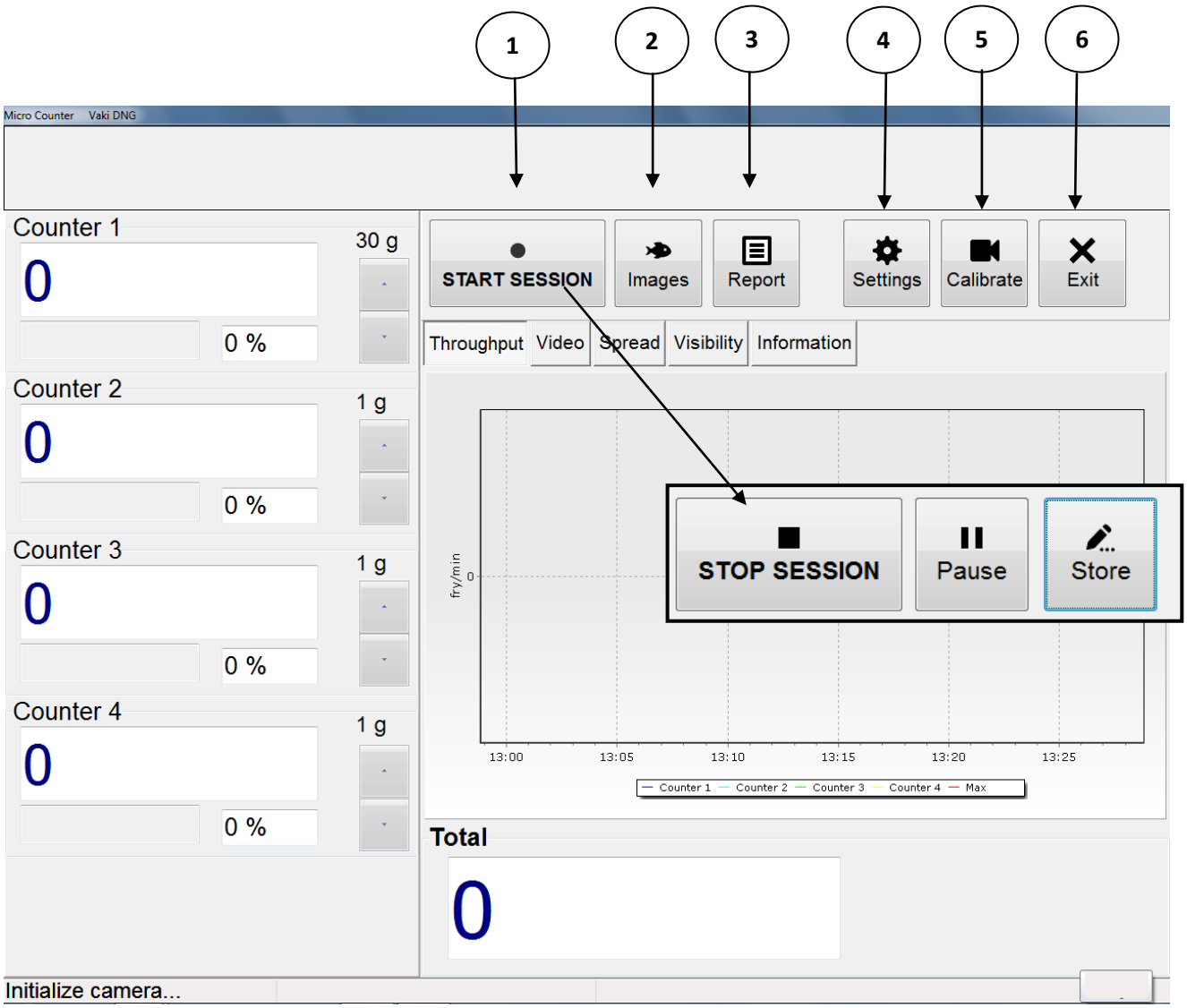


If the counter has been used recently and the lamp has not cooled it is possible to skip this by pressing, "**Cancel**".

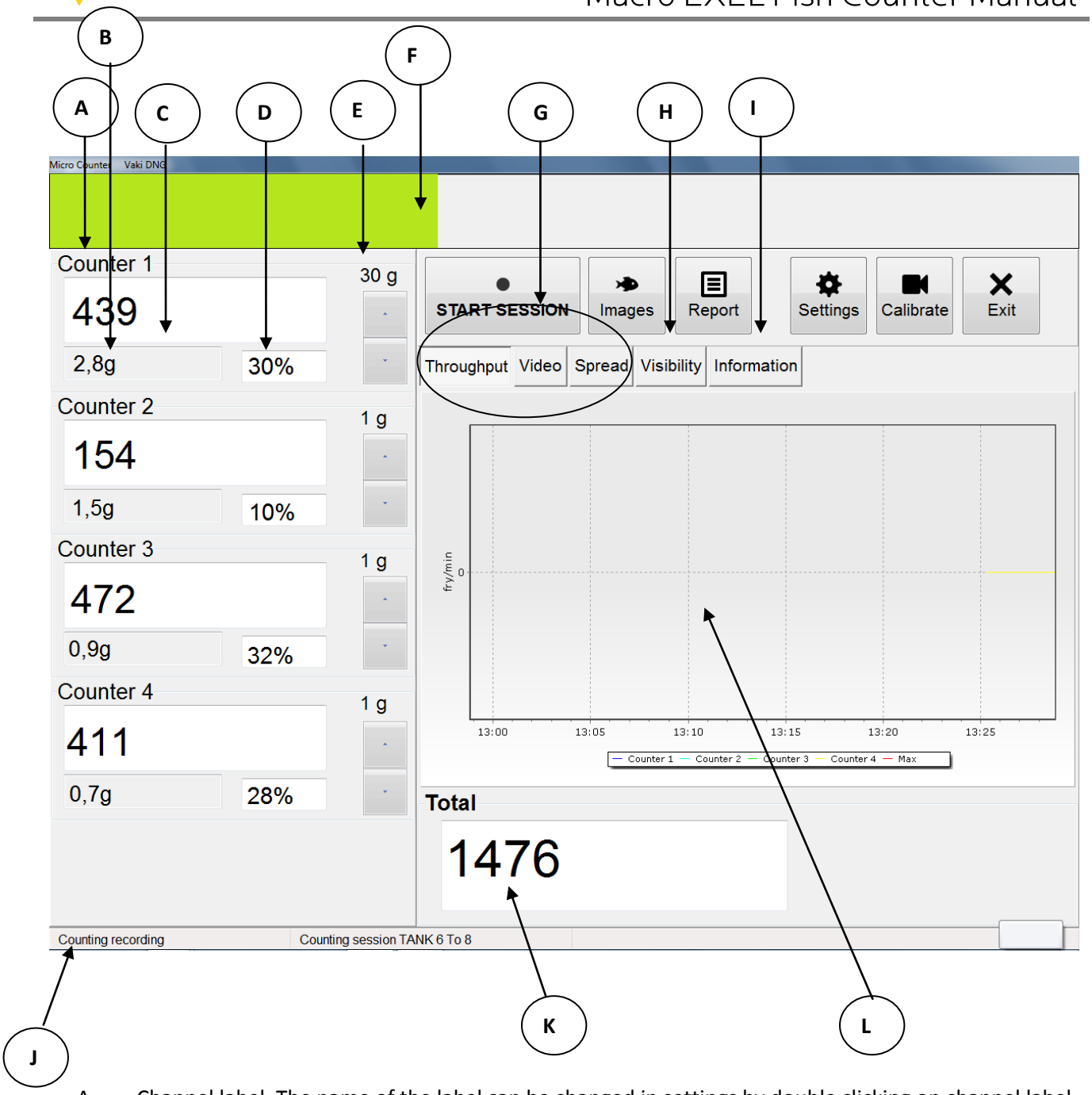
The main screen will then be shown.

Main Screen

The features and options shown on the main screen are as follows.



1. "**New counting session"** starts a new counting session, once activated this button will change to "**End counting session**"
   "**Pause**" to pause the counting when cleaning mirror. Remember to press again to start counting.
   "**Store**" to store an intermediary batch count to the counting report.
   Reminder: if counting in batches remember to store the last batch before ending the counting session
2. "**Image**" to view recorded images.
3. "**Report**" to view counting reports.
4. "**Settings**" access settings menus.
5. "**Calibration**" to automatically calibrate the counter.
6. "**Exit**" to close the software before switching of counter.



A. Channel label. The name of the label can be changed in settings by double clicking on channel label.
B. **Estimated Size** gives the average weight for each counting channel. The moving blue bar is an indication of the sample level, once sample is complete the average weight is displayed
C. **Shows the count** in each channel,
D. **Shows the %** of fish in that channel.
E. **Size group** selected with size group buttons below. Set the size group closest to average fish size to be counted for each channel
F. **Progress Bar** indicates the rate of fish passing through the counter, turning yellow and then red when over capacity.
G. For selection between **Throughput, Video or Fish spread** on the screen.
H. "**Visibility**" used to display the graph showing intensity of light detected by camera.
I. **Information.** Information about the counter head. Type, IP address, Scan rate, Light strength, Serial number, Software version and more.

J. **"Counting"** / or "**Not counting**" message indicates if counter is ready to count.
If this area turns red and shows as "Not counting" and the error message "visibility insufficient" appears, please refer to Calibration & Visibility Section of this manual.

K. **Total count** including all batches stored in the counting session. If tabbed twice it shows Sub Total

L. **Throughput** graph, the lines show the rate of fish passing through the counter and the red shows the maximum capacity the counter can accept.

Set Fish Size

The size groups are: 0.1g, 0.3g, 1g, 3g, 10g, 30g, 100g, 300g etc.

Using the size group buttons set the size group closest to the average size you intend to count. Each size setting covers a range of fish approximately 5 x smaller and 5 x larger than the size setting.

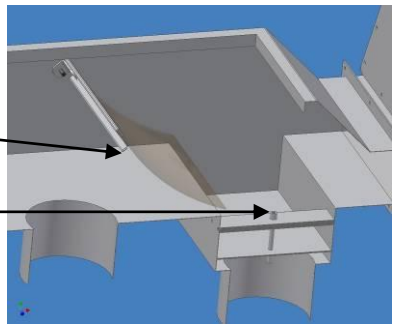
Should sensitive settings for very small fry count small air bubbles, water disturbance, or suspended particles it is advisable to increase the initial size range.

Test with water only

Adjust the amount of water from the fish pump to suit the size of fish being counted. With smaller fish, reduce the amount of water as much as possible running through the counter to prevent miscounting. Use the dewatering valve to adjust the water level.

The plastic flap is used to even the flow of water and fish through the counter.

The dewatering valve is adjusted using this screw



Test run with water only through the counter and check that the counter does not show any counts due to water disturbance.

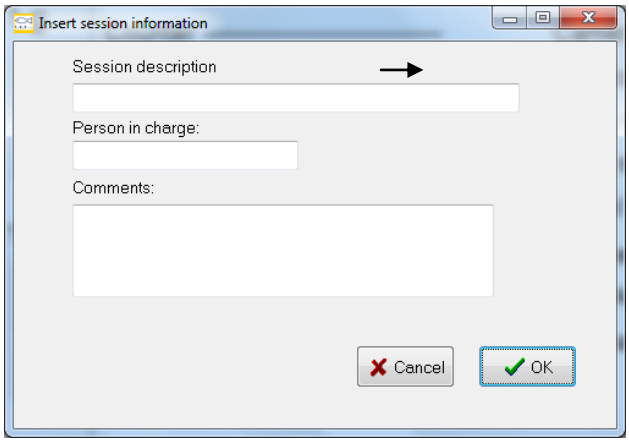
It may be necessary to adjust the flow of water to prevent this, particularly with small fry. If the counter is "counting the water", this may be due to:

- The surface of the mirror is dirty or has water splashes.
- Too much water is being pumped through the counter.
- The water may be too dirty.
- The counter is not level and/or the water is not evenly spread over the counting channel.
- The size range setting is too sensitive.

Start Counting Session

To start counting press "**New counting session**" button on the main screen.

The display will show:

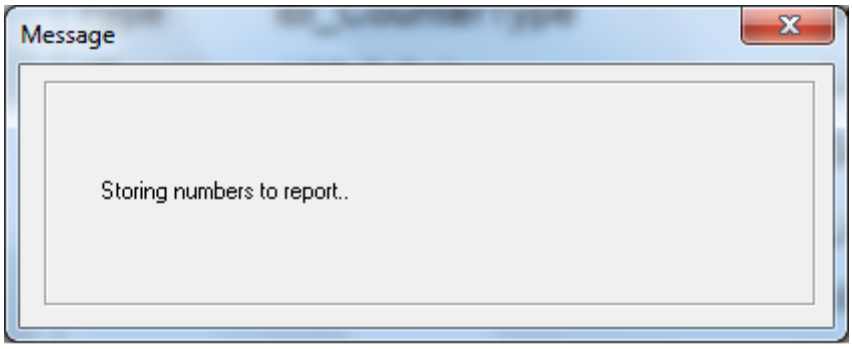


Text such as the site name, tank identification, the population / year class can be entered by pressing the keyboard buttons as indicated. This information will be included in the report. Press "**Enter**" on the keyboard after typing**. IT IS IMPORTANT THAT ONLY LETTERS AND NUMBERS ARE USED WHEN A NAME IS GIVEN. DO NOT USE SIGNS SUCH AS (/ , . & - OR THE DATA FILE WILL NOT BE SAVED.**

The counter should now show 0 in all counting windows. Start pumping or netting the fish into the counter.

Store and Continue Counting

An intermediate count can be stored by pressing the "**Store**" button. Then the following message will be shown.



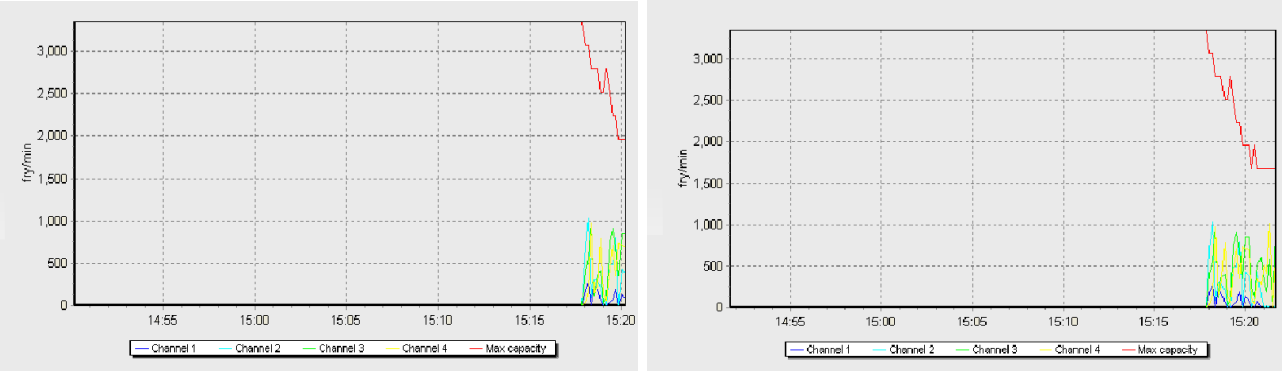
The number will be stored to the report together with the time label.

Troughput Video and Fish spread

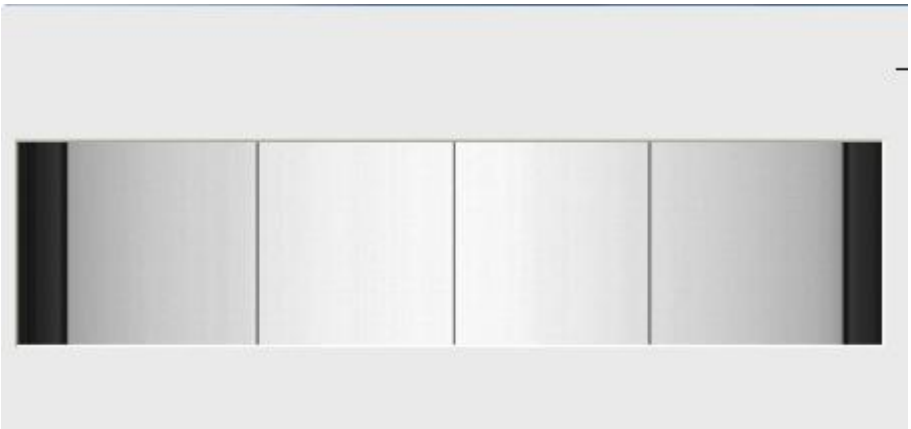
The Video tab shows the real time camera image of the scanning area. This screen can be used to view how the fish pass thru the counter and identify any obstructions or objects remaining in the camera´s field of view.

The Fish spread function shows a graphical representation of the position and quantity fish passing thru the counter across the scanning area. An even spread of fish across the scanning area will give maximum capacity and accuracy.

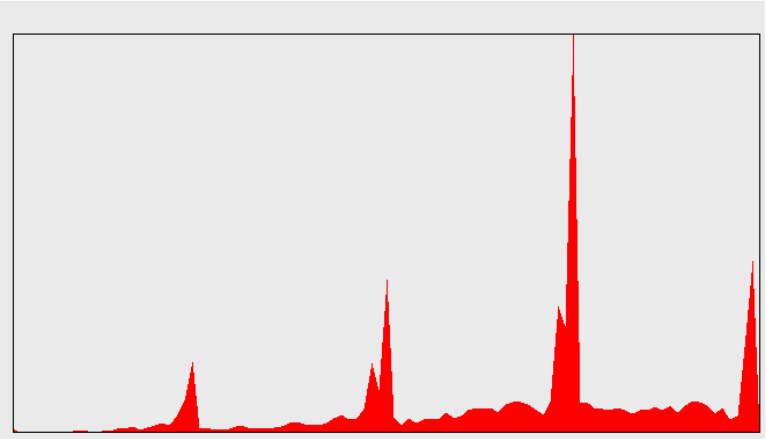
Throughput:



Video:



Fish spread:

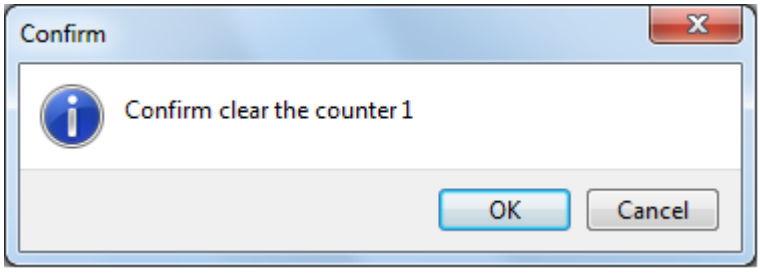


Progress bar

The progress bar gives an indication of the rate of fish going through the counter and relation to counter capacity limit. The progress bar will change from green to amber as the flow rate of fish increases toward maximum counter capacity and finally go red when the flow rate is on or over the maximum limit of the counter.

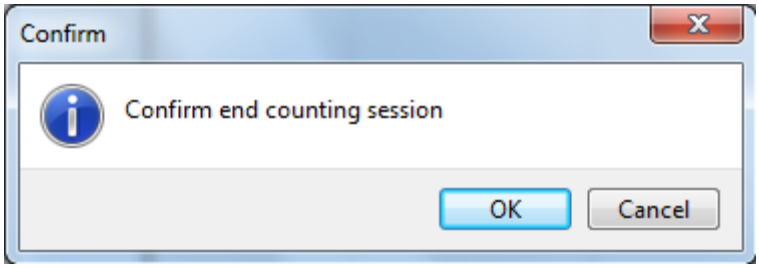
Clear one channel

It is possible to reset the number each counting channel, this will set the channel count back to „0“ but will not affect the total count.



End counting session

When counting is finished, press **“End counting session**”.



The counting report containing information on the counting session including total and individual channel counts, stored numbers, and the image record are stored.

Settings

To access the settings function press **"Settings"** on the main screen.

Settings

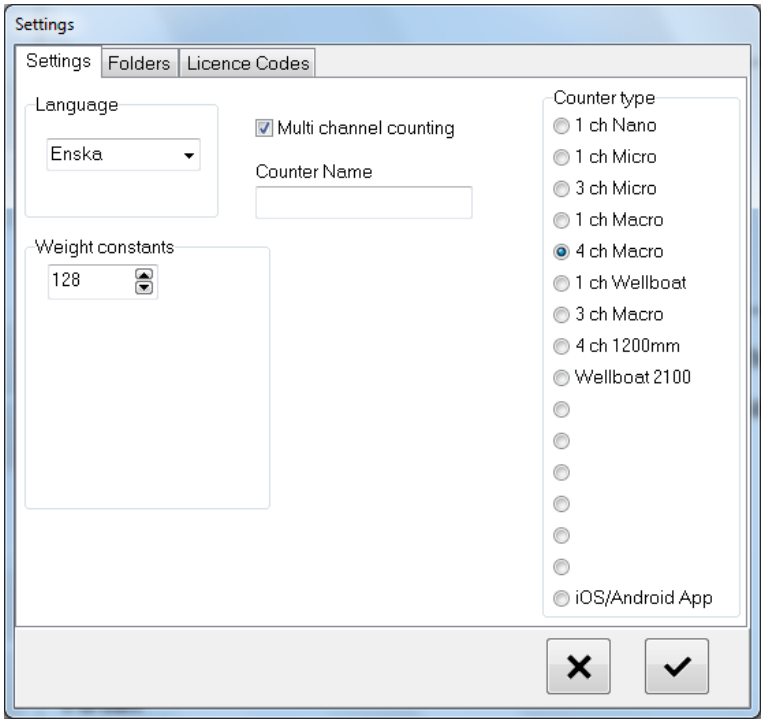
In the screen below it is possible to choose between **languages**. Select the species for the biomass function and the **weight constants** can also be used to fine tune the average weight calculations for each group.

Both Micro and Macro counters are available in multi-channel configurations which can be used for counting from graders. The Multi-channel versions of the counters may also be used in a single channel mode.

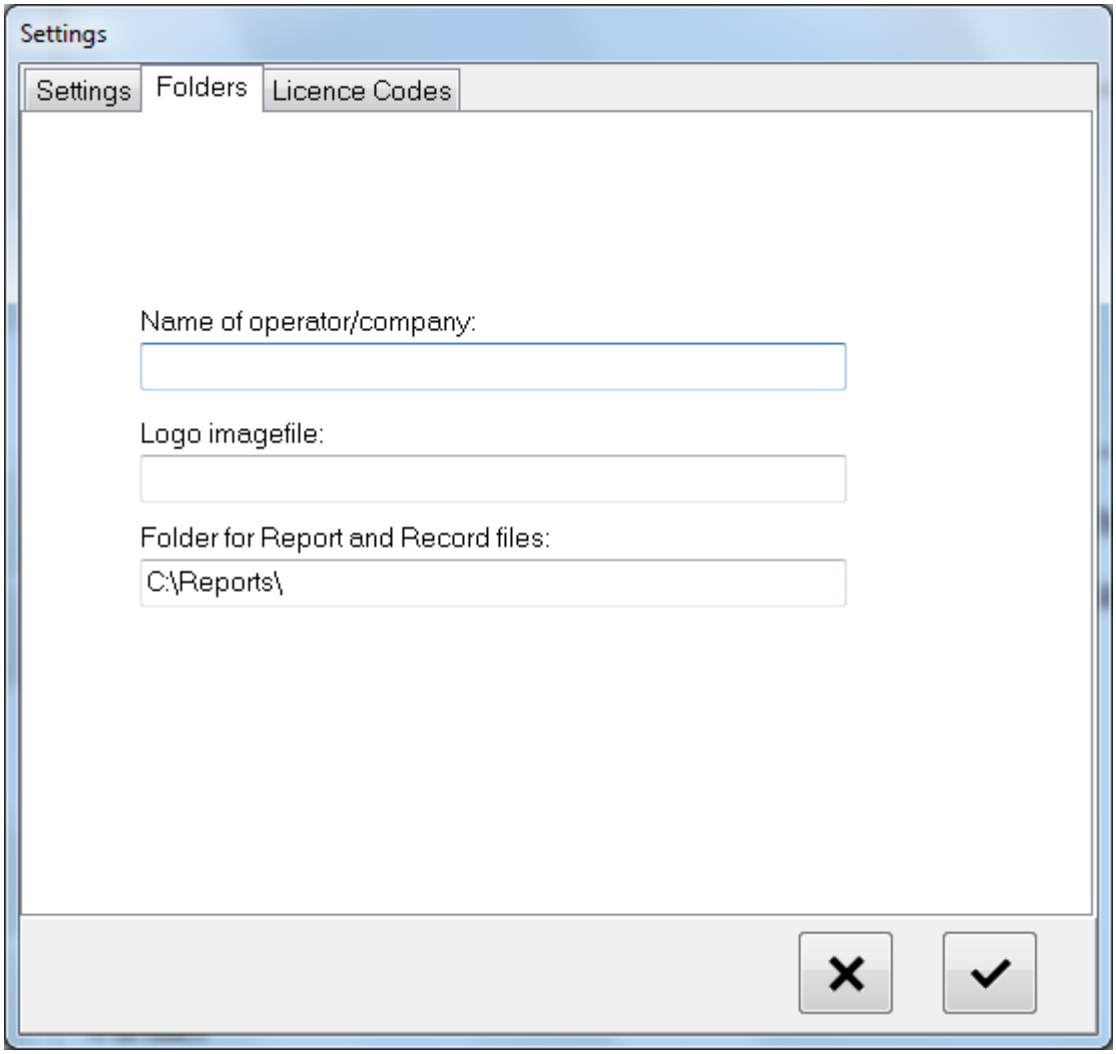
To convert a multi-channel counter to single channel version remove the channel dividers from the counter inlet. Fish can then be pumped directly into the counter via the upwelling inlet underneath the counter or netted directly into the inlet. The multi-channel outlet can be also be removed and replaced with the single outlet.

The counting program is changed between multi and single channel modes by checking the Multi-channel counting box as shown in the **Settings** screen below. The **Channel Labels box** are used to rename the counting channels (Counter 1, Channel 1, Small, Large, etc).

It is recommended to leave the program in multi-channel counting mode even when using the counter as a single channel counter. This allows the monitoring of the numbers of fish passing through each channel section within the counter to ensure that fish are spread evenly across the counter, maximising capacity



Folders



Here it is possible to enter the name of the operator and the company and an image file with the company logo to include in the Count Reports.

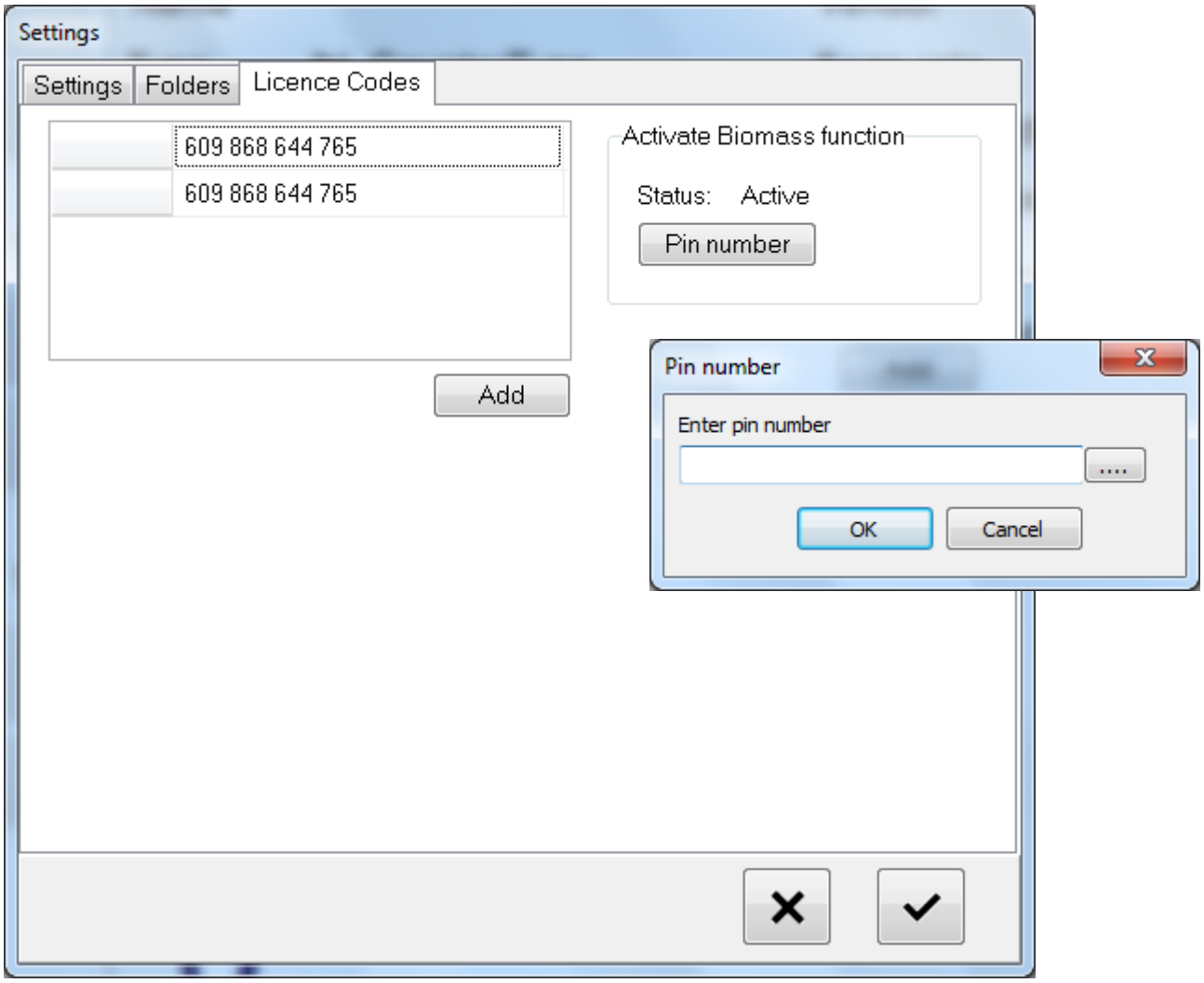
Folder for Report and Record file: shows where the folder is located that stores the report and image files created after a counting session. The present folder is c:\reports\. Licence codes

Licence codes

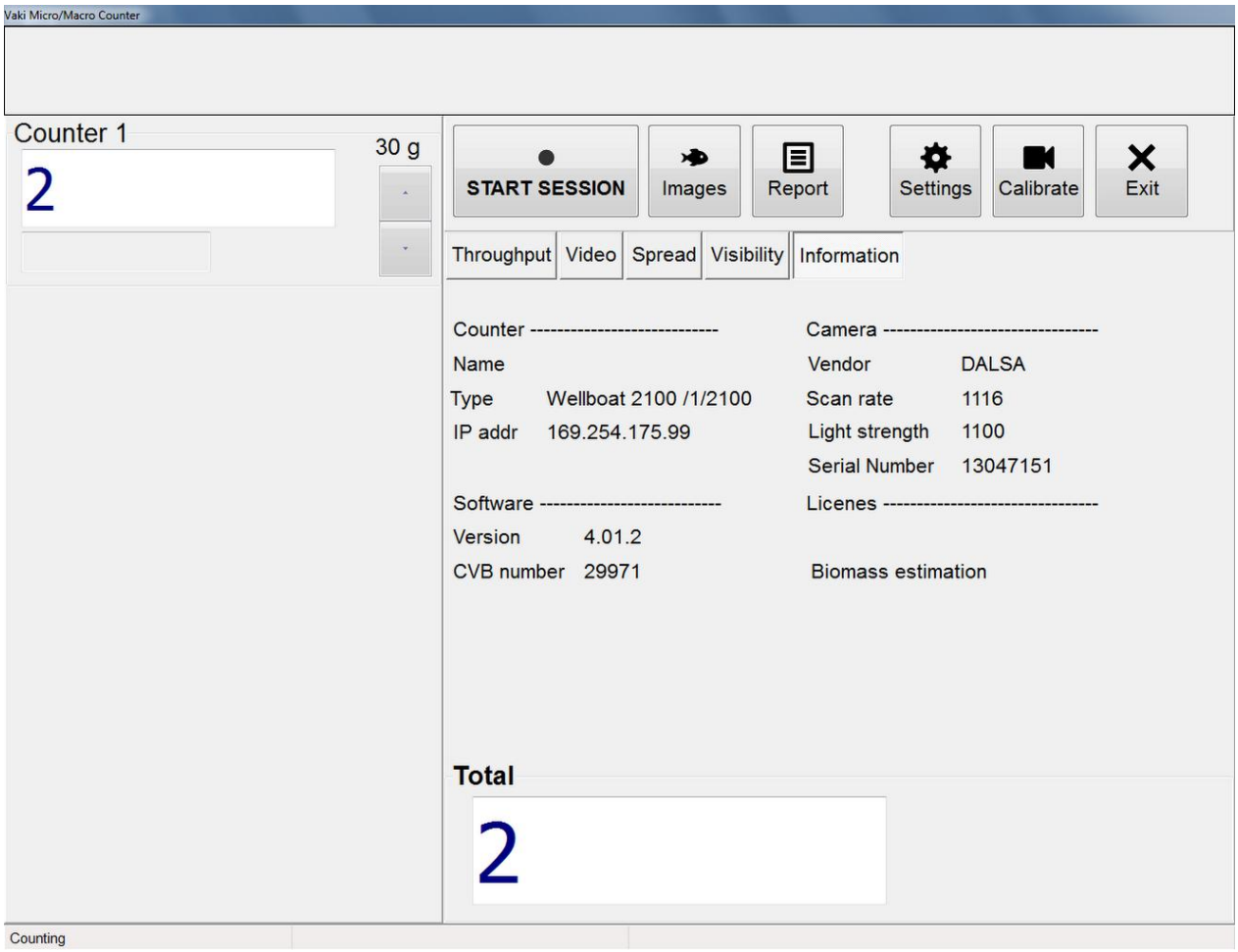
This field shows current licence codes running on the counter.

"Active Biomass function" Indicates the status of the biomass function.

To Activate the Biomass functions insert Biomass pin number for this counter.



Information



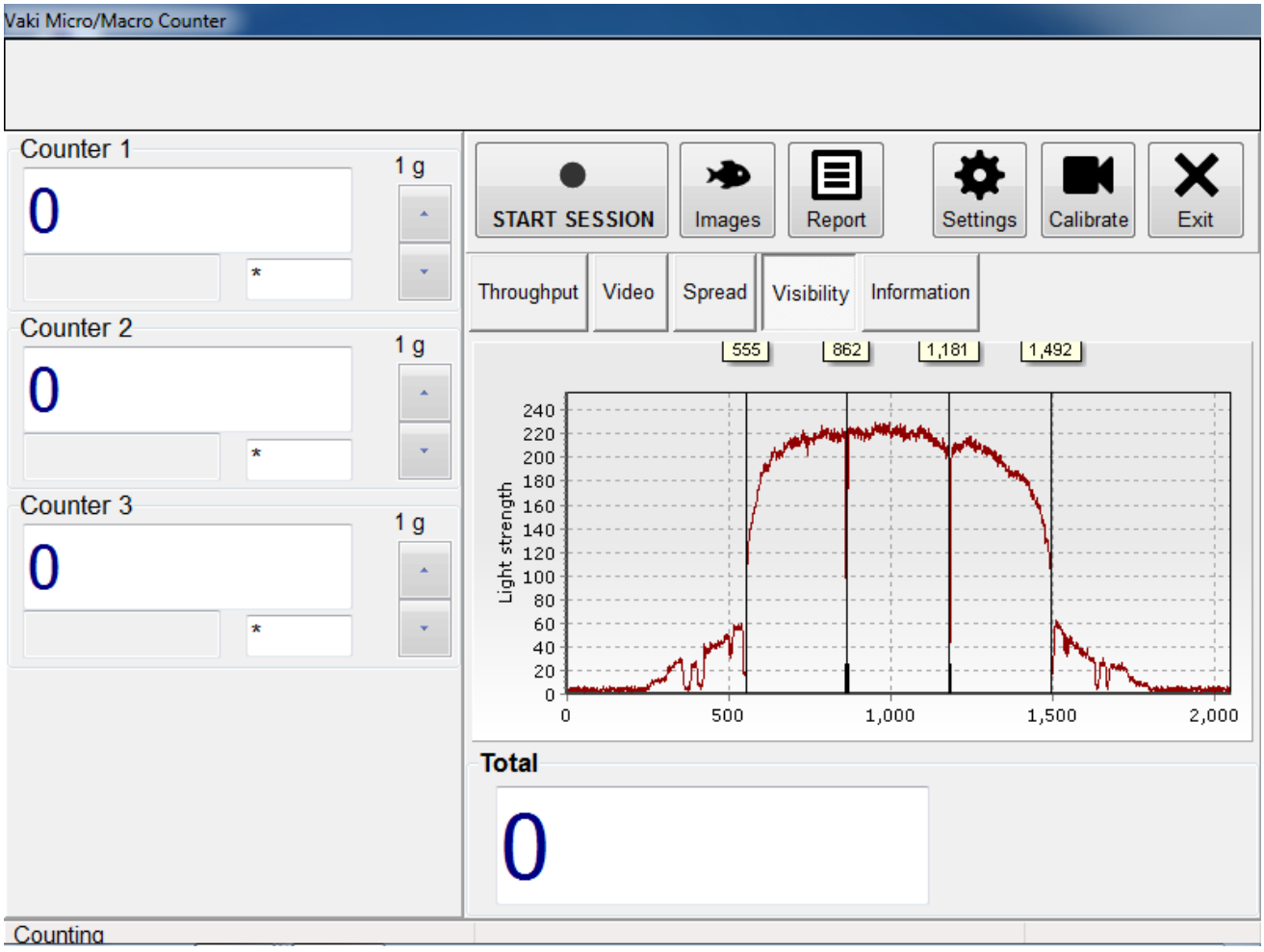
Counter: Name: Name of the counter. Type: Type of the counter. Micro, macro, nano... IP Address: The computer IP Address	**Camera** **Vendor:** Vendor type. **Scan rate:** Shows how many lines per second the camera is scanning. **Light strength:** This value indicates the strength of the lamp. Normally this value should be 1000-1400. Should the value drop below 700 this suggests the lamp tube should be replaced. **Serial number:** Serial number of the counter.
Software: **Version:** program version number**.** **CVB number:** Common Vision blog nr.	**Licence** **Biomass estimation** To buy Biomass Licence you have to contact VAKI and give up version, CVB number and Serial number.

Calibration & Visibility

Each time the counter starts it carries out the following checks:

- The scanning area of the camera.
- That the counter detect all internal bulkheads
- The intensity of the light detected by the camera.

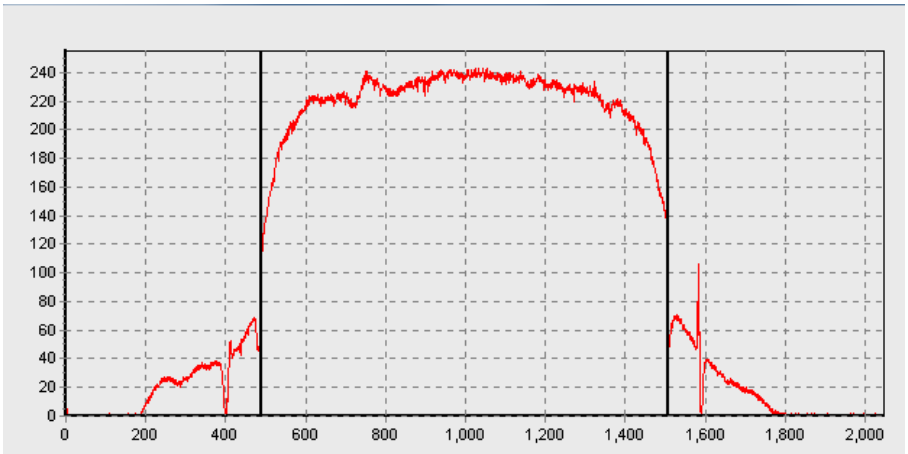
If the visibility is not acceptable, the following message will appear "**Insufficient visibility check again?**" To find what is wrong, push the "**Visibility**" button.



Visibility

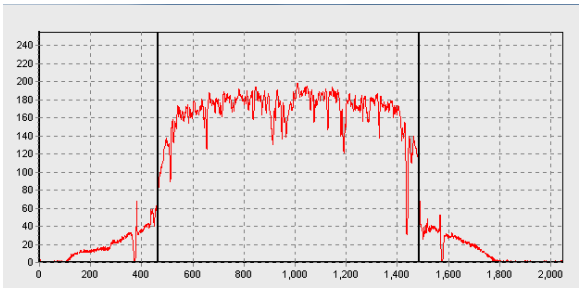
Press **"Visibility"** button to show the visibility graph:

The black vertical lines indicate the edges of the area scanned by the camera, which should correspond to the inside edges of the counting channel.



The "**Visibility"** function is also used to check that the camera is correctly positioned and the amplification of the light is correct. It is also possible to check if dirt or residue blocks or disturbs the sight of the camera.

This diagram on the left shows how the graph should look in a single channel Macro. It shows the position of the edges of the scanning area with two vertical black lines. It also shows that the light intensity detected by the camera is even. The scanning area on this graph is the distance between 500 and 1500 on the x-axis, and on the y-axis, the strength of the light is approx. 220. The x-axis is the length of the scanning area in pixels (1 pixel = appx.0.55 mm). The graph for Micro should indicate 900 pixels (500mm) and the Macro 1,800 pixels (1,000mm). The y-axis is the strength of the light on scale 0 to 255. The counter ignores the area outside the edges. If the strength is under 180 or over 250, the counter must be re-calibrated. (See section: **10.2 Counter Calibration**)

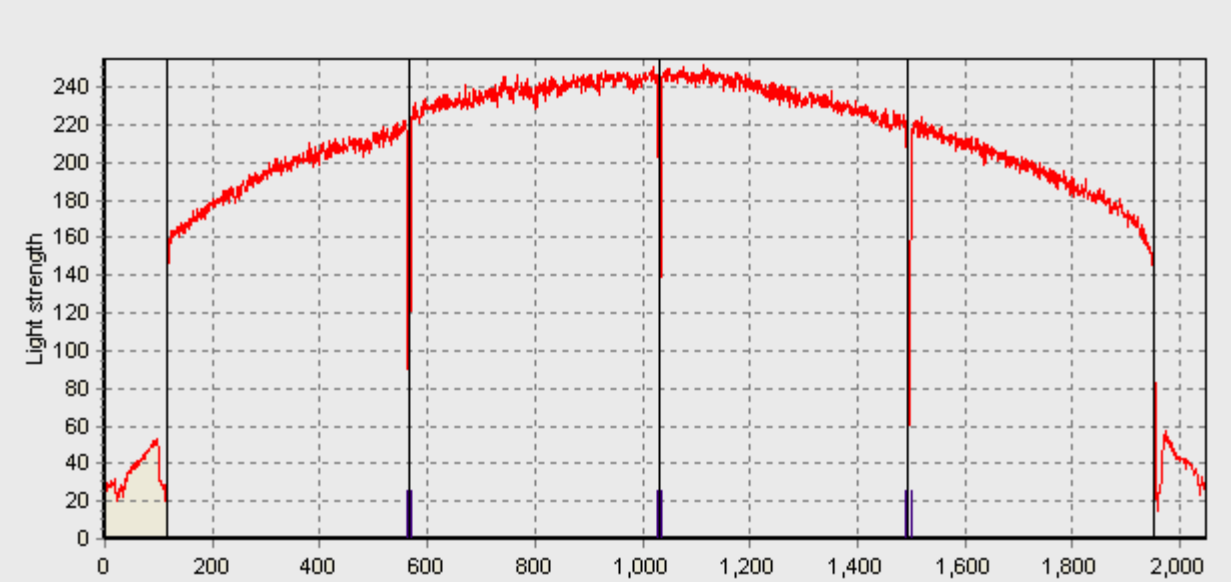


The diagram on the right shows how the graph can look when something disturbs the light. In this case, the reason may be humidity or dirt on the mirror. This would prevent calibration of the camera. In this case, it is necessary to clean the mirror.

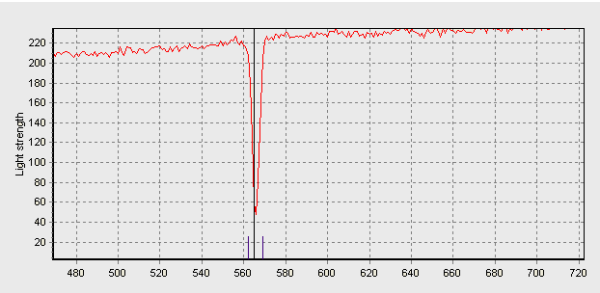
The black vertical lines should be positioned where the light intensity (shown by the red curve) falls steeply. If not it is necessary to re calibrate (see Counter Calibration).

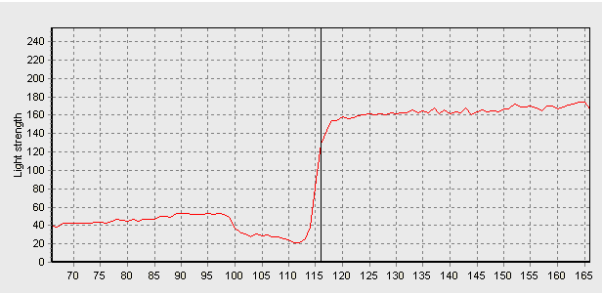
Visibility graph

Below is the curve for a four channel Macro.



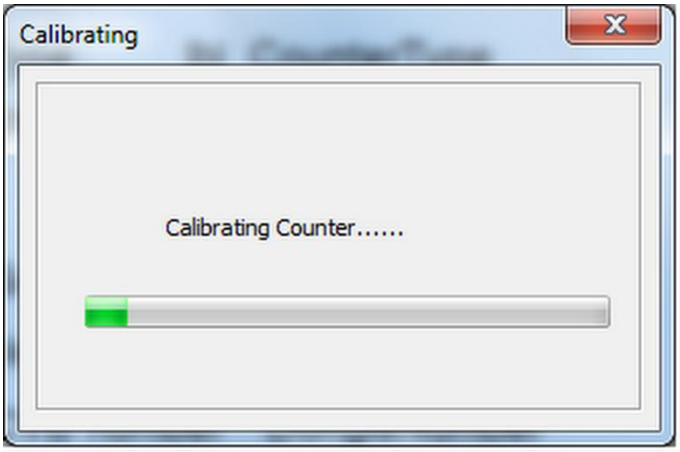
It is possible to zoom. To zoom in click on the screen and drag the mouse.





If no red curve appears this may be caused by, no light source (lamp) or the counting head is not positioned correctly on the counter body.

Counter calibration

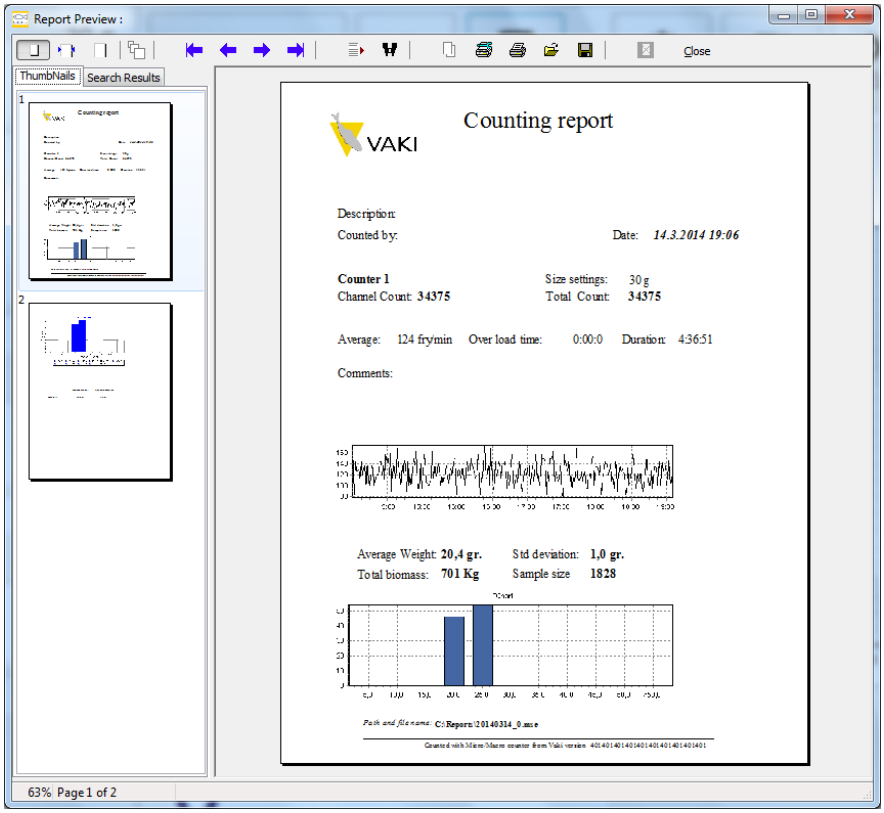


The Calibration function calculates a new position automatically. Press “Calibration” button on main screen with no water running through the counter.

It is also important that the lamp has been on for five minutes or more and the mirror and camera window are clean. Wait until counting message appears on bottom left of screen. It is good practice to re check the “Visibility” graph. If the edges of the scanning area are still not acceptable then it may need to be done manually.

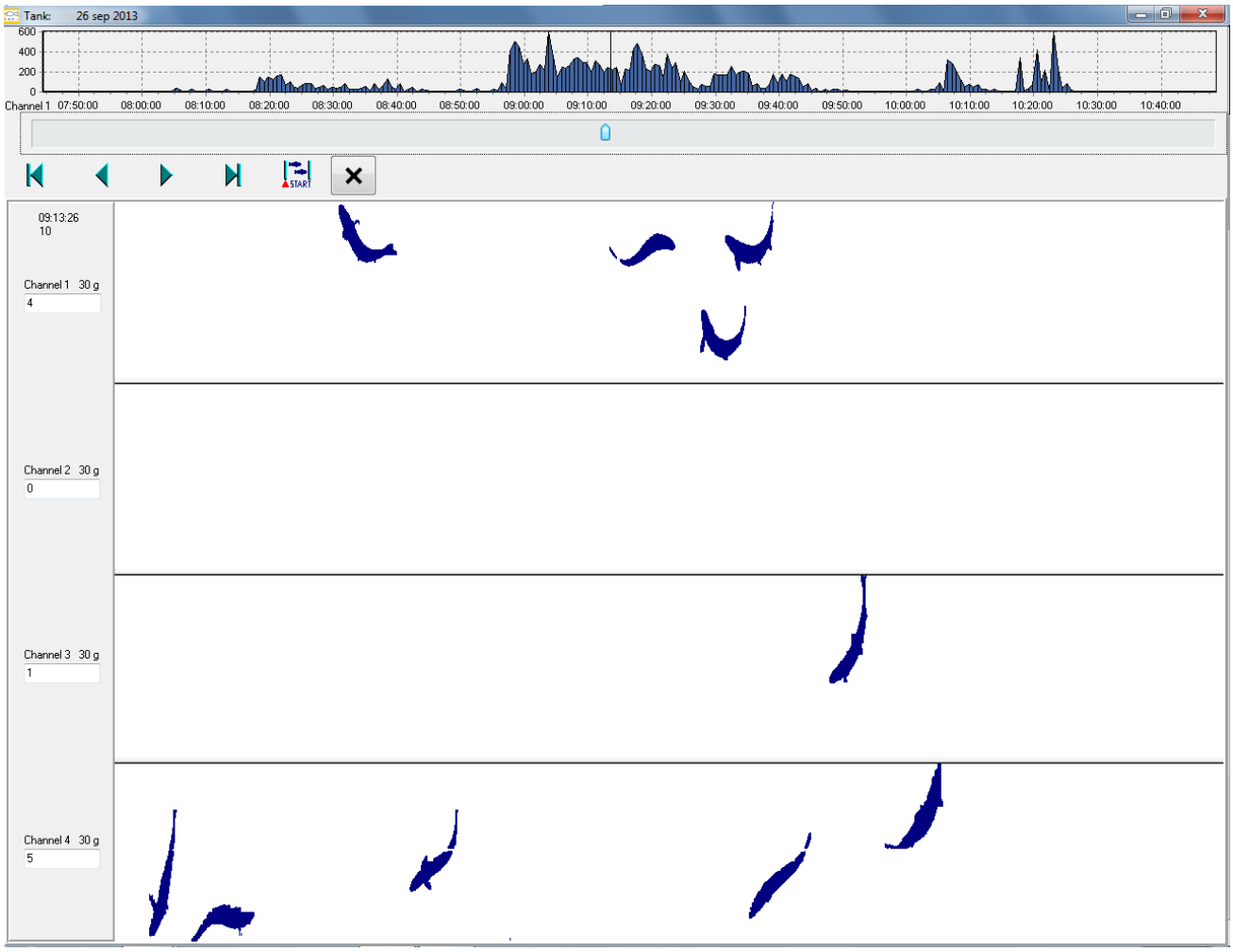
View report

After pressing “End counting session”, the programme automatically creates a report file. To open and view the reports press the “Report” button on main screen. A list of all stored counting reports is displayed. Each report is labelled by date and tank name. With the Biomass function the average weight, total biomass, standard deviation, and size distribution chart is included in the report.



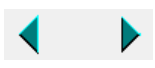
A company logo can be printed on the top right of the report. The logo must be in a Windows Bitmap format and under the filename logo.bmp in the folder c:\Reports

View record



To view the images stored press "**Record**" on the main screen. The files are labelled by date and tank name, open the file to be viewed from the list. Each screen shows a recording for around one-second interval.

The graph at the top of the screen indicates the rate of fish through the counter over time. Press the graph and a graph for the next counting channel will be shown.

 Buttons are used to move to the next screen

Buttons locate the beginning and end of the recording.

Start/End button, is used to select a part of the recording to be counted.

The pointer indicates the location of the screen currently viewed and can be dragged to quickly locate a position in the recording.

"Close" to exit.

Storing

When storing the Micro or Macro it is important to bear the following in mind:

- Store the Counting Head in a safe, dry place where there are minimum temperature fluctuations.
- Clean any salty seawater off the counter with fresh water after use.
- Ensure the counting head is handled with care.

Technical specification

Material: Stainless steel (AISI 316L)

Power consumption: 110/220 V

UPS requirement: 80-100W

Size of inlet/outlet pipes: 6”

Size of dewatering pipe: 6”

Fish size: 0.1g. – 400g.

Capacity:
up to 1.250.000 1g. fish per hour.
up to 250.000 50g. fish per hour.

Accuracy: 98% -100%

Fish species: Sea bass, sea bream, salmon, trout, halibut, turbot, tilapia, cod, yellow tail, turbot and ornamentals.